

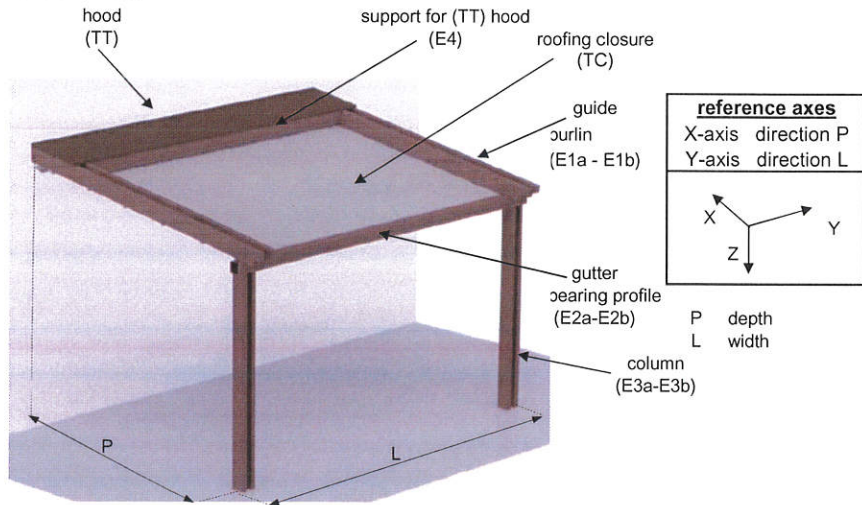
STRUCTURAL REPORT

WOOD PLUS

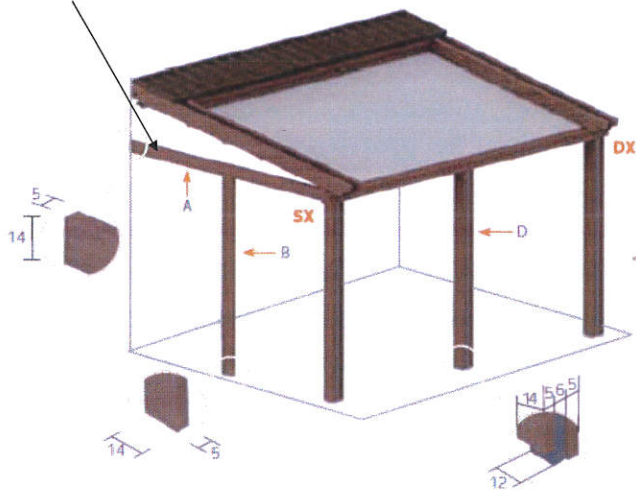
Pratic
THE OPEN AIR CULTURE

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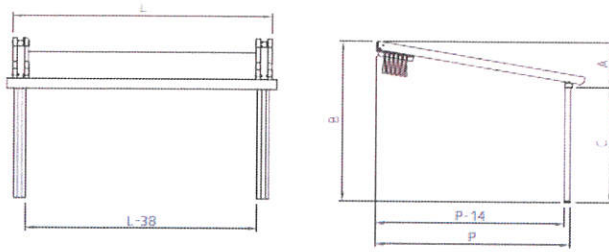
tridimensional view



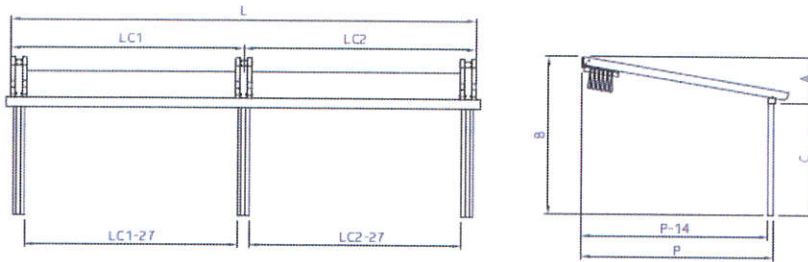
additional profiles
tympanum



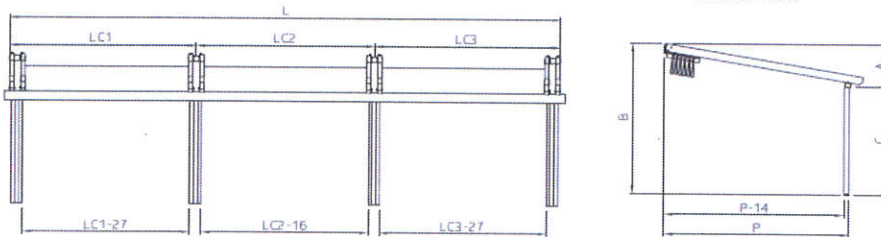
WOOD PLUS 1 span
 frontal view lateral view



WOOD PLUS 2 spans
 frontal view lateral view

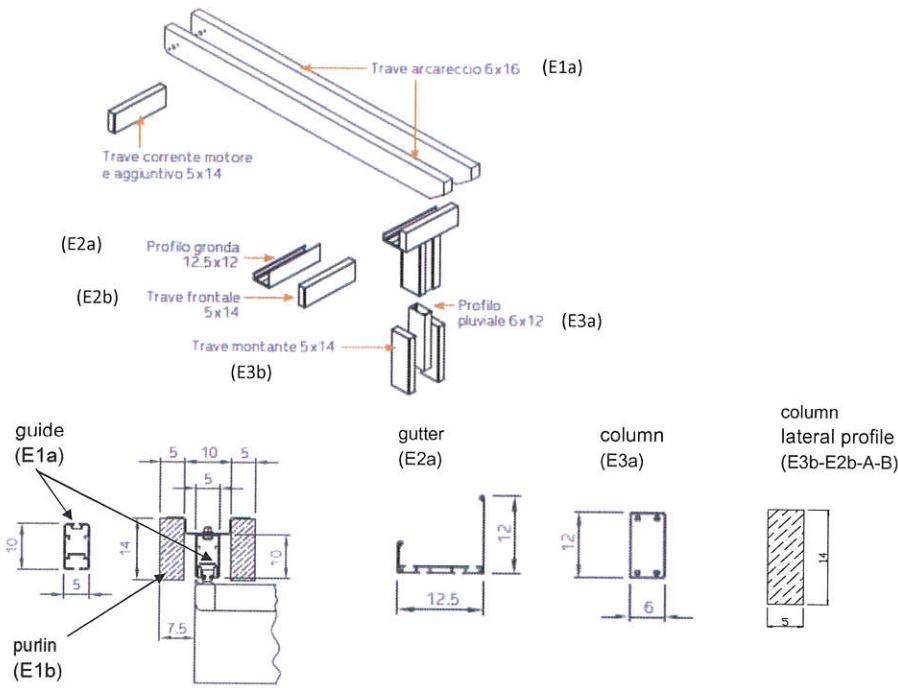


WOOD PLUS 3 spans
 frontal view lateral view



Frame profiles

guide	aluminum	E1a
purlin	timber	E1b
gutter	aluminum	E2a
lateral profile	timber	E2b
column	aluminum	E3a
	timber	E3b-B-D
support for (TT) hood		E4
lateral profile		A



Materials

extruded aluminum

type EN AW - 6060 T6

steel

type Aisi 304 - Aisi 470 Li

fasteners and bolts

category A2/70 (UNI EN ISO 3506-1:2009)

timber

type glue laminated timber catego GL24h

codes

UNI EN 1990:2006	Eurocode 0 Basis of structural design
UNI EN 1991-1	Eurocode 1 Actions on structures, Part 1-1 and 1-3 (2004), 1-4 (2005)
UNI EN1995-1-1:2005	Eurocode 5 Design of wood structures , Part 1-1: general rules
UNI EN 1998-1:2005	Eurocode 8 Design of structures for earthquake resistance, Part 1
UNI EN 1999-1-1:2007	Eurocode 9 Design of aluminium structures, Part 1-1: general rules
UNI EN 13561:2004	External blinds- Performance requirements including safety

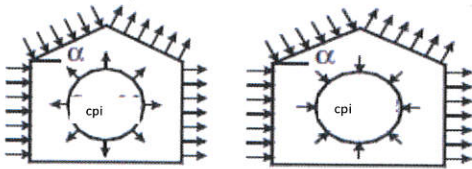
scheme of the wind action on the structure

structure with perimetral closure

in this condition the wind acts on the roofing and perimetral closure

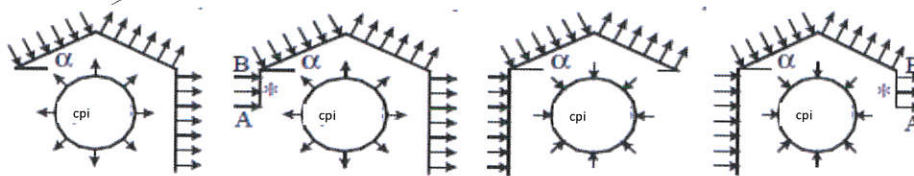
presence of openings < 33%

wind direction



presence of openings >= 33%

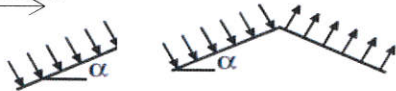
wind direction



structure without perimetral closure

in this condition the wind acts on the roofing closure and the elements

wind direction



Calculation ipotesys

The structure has been evaluated with the following calculation ipotesys

h = 2,30 m height at the guide bottom side

category (ground II corresponding to "Area with low vegetation such as grass and isolated obstacles (trees, buildings) with separations of at least 20 obstacle heights"

Adopted static scheme

roofing elements: supported beam 1 span
vertical elements: cantilever

CONDITIONS OF USE

structure with optionals for perimetral closure

load condition	closure		anemometer	table values
	roofing	perimetral		
1	folded	rolled up	off	beaufort
2	unfolded	rolled up	off	beaufort
3	unfolded	not rolled up	active for side and front vertical awnings	max. speed (km/h)

snow load considered only in condition 1

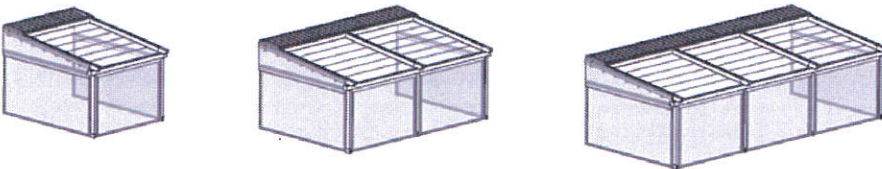
condition 1



condition 2



condition 3



structure without optionals for perimetral closure

load condition	closure roofing	table values
1	folded	beaufort
2	unfolded	beaufort

snow load considered only in condition 1

condition 1



condition 2



- BEAUFORT #**
- 1 = 0.7-3.4 mph
 - 2 = 3.4-7.4 mph
 - 3 = 7.4-12.2 mph
 - 4 = 12.2-17.9 mph
 - 5 = 17.9-24.1 mph
 - 6 = 24.1-31 mph
 - 7 = 31-38.4 mph
 - 8 = 38.4-46.3 mph
 - 9 = 46.3-54.8 mph
 - 10 = 54.8-63.6 mph

WIND RESISTANCE TABLE - Beaufort scale

structure without optionals for perimetral closure

load condition	closure roofing	table values
1	folded	beaufort
2	unfolded	beaufort

snow load considered only in condition 1

WOOD PLUS		1 SPAN						brackets
structure without optionals for perimetral closure		CONDITION 1						
depth P		width L						
		250	300	350	400	450	500	
200	11	11	10	10	9	8	7	4
250	11	11	10	10	9	8	7	4
300	10	10	10	10	9	8	7	4
350	10	10	10	10	9	8	7	6
400	10	10	10	10	9	8	7	6
450	9	9	9	9	8	7	6	6
500	9	9	9	9	8	7	6	6
550	9	9	9	9	8	7	6	6
600	9	9	9	8	8	7	6	8
650	8	8	8	8	8	7	6	8
700	8	8	8	8	8	7	6	10

WOOD PLUS		1 SPAN						brackets
structure without optionals for perimetral closure		CONDITION 2						
depth P		width L						
		250	300	350	400	450	500	
200	10	9	8	7	7	6	4	4
250	10	9	8	7	7	6	4	4
300	10	9	8	7	7	6	4	4
350	10	9	8	7	7	6	6	6
400	10	9	8	7	7	6	6	6
450	9	9	8	7	7	6	6	6
500	9	9	8	7	7	6	6	6
550	9	9	8	7	7	6	6	8
600	8	8	8	7	7	6	6	8
650	8	8	7	7	7	6	6	8
700	8	7	7	6	6	6	6	10



WOOD PLUS		2 SPANS									brackets
structure without optionals for perimetral closure		CONDITION 1									
depth P		width L									
		500	550	600	650	700	750	800	850	900	
200	11	10	9	8	8	8	8	8	8	4	
250	11	10	9	8	8	8	8	8	8	4	
300	10	10	9	8	8	8	8	8	8	4	
350	10	10	9	8	8	8	8	8	8	6	
400	10	10	9	8	8	8	8	8	8	6	
450	9	9	8	8	8	8	8	8	8	6	
500	9	9	8	8	8	8	8	8	8	6	
550	9	9	8	8	8	8	8	8	8	6	
600	9	9	8	8	8	8	8	8	8	8	
650	8	8	8	8	8	8	8	8	8	8	
700	8	8	8	8	8	8	8	8	8	10	

WOOD PLUS		2 SPANS									brackets
structure without optionals for perimetral closure		CONDITION 2									
depth P		width L									
		500	550	600	650	700	750	800	850	900	
200	9	8	7	7	7	7	7	7	7	4	
250	9	8	7	7	7	7	7	7	7	4	
300	9	8	7	7	7	7	7	7	7	4	
350	9	8	7	7	7	7	7	7	7	6	
400	9	8	7	7	7	7	7	7	7	6	
450	9	8	7	7	7	7	7	7	7	6	
500	8	8	7	7	7	7	7	7	7	6	
550	8	7	7	7	7	6	6	6	6	8	
600	7	7	6	6	6	6	6	6	6	8	
650	7	6	6	6	6	6	6	6	6	8	
700	6	6	6	6	6	6	6	6	6	10	



WOOD PLUS		3 SPANS									brackets
structure without optionals for perimetral closure		CONDITION 1									
depth P		width L									
		900	950	1000	1050	1100	1150	1200	1250	1300	
200	8	8	8	8	8	8	8	8	8	4	
250	8	8	8	8	8	8	8	8	8	4	
300	8	8	8	8	8	8	8	8	8	4	
350	8	8	8	8	8	8	8	8	8	6	
400	8	8	8	8	8	8	8	8	8	6	
450	8	8	8	8	8	8	8	8	8	6	
500	8	8	8	8	8	8	8	8	8	6	
550	8	8	8	8	8	8	8	8	8	6	
600	7	7	7	7	7	7	7	7	7	8	
650	7	7	7	7	7	7	7	7	7	8	
700	7	7	7	7	7	7	7	7	7	10	

WOOD PLUS		3 SPANS									brackets
structure without optionals for perimetral closure		CONDITION 2									
depth P		width L									
		900	950	1000	1050	1100	1150	1200	1250	1300	
200	7	7	7	7	7	7	7	7	7	4	
250	7	7	7	7	7	7	7	7	7	4	
300	7	7	7	7	7	7	7	7	7	4	
350	7	7	7	7	7	7	7	7	7	6	
400	7	7	7	7	7	7	7	7	7	6	
450	7	7	7	7	7	7	7	7	7	6	
500	7	7	7	7	7	7	7	7	7	6	
550	7	6	6	6	6	6	6	6	6	8	
600	6	6	6	6	6	6	6	6	6	8	
650	6	6	6	6	6	6	6	6	6	8	
700	6	6	6	6	6	6	6	6	6	10	

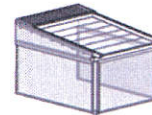
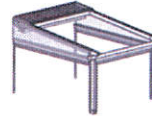


structure with optionals for perimetral closure

load conditions	closure		anemometer	table values
	roofing	perimetral		
1	folded	rolled up	off	beaufort
2	unfolded	rolled up	off	beaufort
3	unfolded	not rolled up	active for side and front vertical awnings	max. speed (km/h)

snow load considered only in condition 1

WOOD PLUS 1 SPAN							
structure with optionals for perimetral closure							
CONDITION 1							
depth P	width L						brackets
	250	300	350	400	450	500	
200	10	10	10	9	8	7	4
250	9	9	9	9	8	7	4
300	9	9	9	8	8	7	4
350	8	8	8	8	8	7	6
400	8	8	8	8	8	7	6
450	7	7	7	7	7	7	6
500	7	7	7	7	7	7	6
550	7	7	7	7	7	7	8
600	7	6	6	6	6	6	8
650	6	6	6	6	6	6	8
700	6	6	6	6	6	6	10
CONDITION 2							
depth P	width L						brackets
	250	300	350	400	450	500	
200	10	9	8	7	7	6	4
250	9	9	8	7	7	6	4
300	9	8	8	7	7	6	4
350	8	8	8	7	7	6	6
400	8	8	7	7	7	6	6
450	7	7	7	7	7	6	6
500	7	7	7	7	7	6	6
550	7	7	6	6	6	6	8
600	6	6	6	6	6	6	8
650	6	6	6	6	6	6	8
700	6	6	6	6	6	6	10
CONDITION 3							
depth P	width L						brackets
	250	300	350	400	450	500	
200	88	74	64	56	51	46	4
250	88	74	64	56	51	46	4
300	85	74	64	56	51	46	4
350	79	74	64	56	51	46	6
400	73	72	64	56	51	46	6
450	69	68	64	56	51	46	6
500	65	64	62	56	51	46	6
550	61	60	59	56	51	46	8
600	58	57	56	55	51	46	8
650	56	54	53	52	50	46	8
700	53	52	50	47	45	44	10



WOOD PLUS 2 SPANS
structure with optionals for perimetral closure

CONDITION 1

depth P	width L									brackets
	500	550	600	650	700	750	800	850	900	
200	10	10	9	8	8	8	8	8	8	4
250	10	10	9	8	8	8	8	8	8	4
300	9	9	9	8	8	8	8	8	8	4
350	9	9	9	8	8	8	8	8	8	6
400	8	8	8	8	8	8	8	8	8	6
450	8	8	8	8	8	8	8	8	8	6
500	8	8	8	7	7	7	7	7	7	6
550	7	7	7	7	7	7	7	7	7	8
600	7	7	7	7	7	7	7	7	7	8
650	7	7	7	7	7	7	7	7	7	8
700	7	7	7	6	6	6	6	6	6	10



CONDITION 2

depth P	width L									brackets
	500	550	600	650	700	750	800	850	900	
200	9	8	7	7	7	7	7	7	7	4
250	9	8	7	7	7	7	7	7	7	4
300	9	8	7	7	7	7	7	7	7	4
350	9	8	7	7	7	7	7	7	7	6
400	8	8	7	7	7	7	7	7	7	6
450	8	8	7	7	7	7	7	7	7	6
500	8	7	7	7	7	7	7	6	6	6
550	7	7	7	6	6	6	6	6	6	8
600	7	6	6	6	6	6	6	6	6	8
650	6	6	6	6	6	6	6	6	6	8
700	6	6	6	6	6	6	6	6	6	10



CONDITION 3

depth P	width L									brackets
	500	550	600	650	700	750	800	850	900	
200	74	64	56	51	51	51	51	51	51	4
250	74	64	56	51	51	51	51	51	51	4
300	74	64	56	51	51	51	51	51	51	4
350	74	64	56	51	51	51	51	51	51	6
400	74	64	56	51	51	51	51	51	51	6
450	74	64	56	51	51	51	51	51	51	6
500	68	64	56	51	51	51	51	51	51	6
550	61	58	56	51	51	50	50	48	47	8
600	55	52	50	48	47	46	45	44	43	8
650	50	47	45	44	43	41	40	39	39	8
700	45	43	41	40	39	38	37	36	35	10



WOOD PLUS 3 SPANS
structure with optionals for perimetral closure

CONDITION 1

depth P	width L									brackets
	900	950	1000	1050	1100	1150	1200	1250	1300	
200	8	8	8	8	8	8	8	8	8	4
250	8	8	8	8	8	8	8	8	8	4
300	8	8	8	8	8	8	8	8	8	4
350	8	8	8	8	8	8	8	8	8	6
400	8	8	8	8	8	8	8	8	8	6
450	8	8	8	8	8	8	8	8	8	6
500	8	8	8	8	8	8	8	8	8	6
550	8	8	8	8	8	8	8	8	8	8
600	7	7	7	7	7	7	7	7	7	8
650	7	7	7	7	7	7	7	7	7	8
700	6	6	6	6	6	6	6	6	6	10



CONDITION 2

depth P	width L									brackets
	900	950	1000	1050	1100	1150	1200	1250	1300	
200	7	7	7	7	7	7	7	7	7	4
250	7	7	7	7	7	7	7	7	7	4
300	7	7	7	7	7	7	7	7	7	4
350	7	7	7	7	7	7	7	7	7	6
400	7	7	7	7	7	7	7	7	7	6
450	7	7	7	7	7	7	7	7	7	6
500	7	7	7	7	7	7	7	7	7	6
550	6	6	6	6	6	6	6	6	6	8
600	6	6	6	6	6	6	6	6	6	8
650	6	6	6	6	6	6	6	6	6	8
700	6	6	6	6	6	6	6	6	6	10



CONDITION 3

depth P	width L									brackets
	900	950	1000	1050	1100	1150	1200	1250	1300	
200	51	51	51	51	51	51	51	51	51	4
250	51	51	51	51	51	51	51	51	51	4
300	51	51	51	51	51	51	51	51	51	4
350	51	51	51	51	51	51	51	51	51	6
400	51	51	51	51	51	51	51	51	51	6
450	51	51	51	51	51	51	51	51	51	6
500	51	51	51	51	51	51	51	51	51	6
550	51	50	50	48	47	47	47	47	47	8
600	47	46	45	44	43	43	43	43	42	8
650	42	41	40	39	39	39	39	39	35	8
700	39	38	37	36	35	35	35	33	30	10



MAXIMUM SNOW LOAD

(1 DaN = 1 Kg)

the maximum snow load on the structure with folded roofing closure is

qn =	50 DaN/m ²	azione neve	10.24 lbs/ft ²
gn =	200 DaN/m ³	snow specific weight	12.46 lbs/ft ³
hmax =	25 cm 9.84"	snow maximum height	

FOUNDATION - PLYNTH

the plynth dimensions for the maximum action are

X-axis direction P
Y-axis direction L

1 SPAN

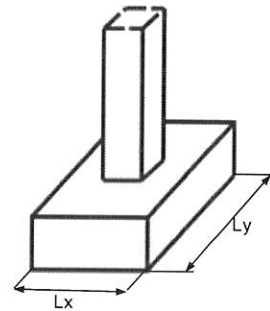
Lx =	1 m 93.4"	dimension X plynth
Ly =	1 m 93.4"	dimension Y plynth
h =	0,5 m 19.7"	plynth thickness
P =	1250 DaN 2750 lbs	plynth total weight

2 SPANS

Lx =	1 m 93.4"	dimension X plynth
Ly =	1 m 93.4"	dimension Y plynth
h =	0,5 m 19.7"	plynth thickness
P =	1250 DaN 2750 lbs	plynth total weight

3 SPANS

Lx =	1 m 93.4"	dimension X plynth
Ly =	1 m 93.4"	dimension Y plynth
h =	0,5 m 19.7"	plynth thickness
P =	1250 DaN 2750 lbs	plynth total weight



ANCHOR BOLT ACTION AT THE BASE OF THE COLUMN

the maximum actions acting on a single anchor bolt are

F =	1500 DaN 3300 lbs	traction
V =	50 DaN 110 lbs	shear

ANCHOR BOLT ACTION AT THE FIXING TO THE ROOF

the maximum actions acting on a single anchor bolt are

F =	1000 DaN 2200 lbs	traction
V =	500 DaN 1100 lbs	shear

ANCHOR BOLT ACTION AT THE FIXING TO THE WALL

the maximum actions acting on a single anchor bolt are

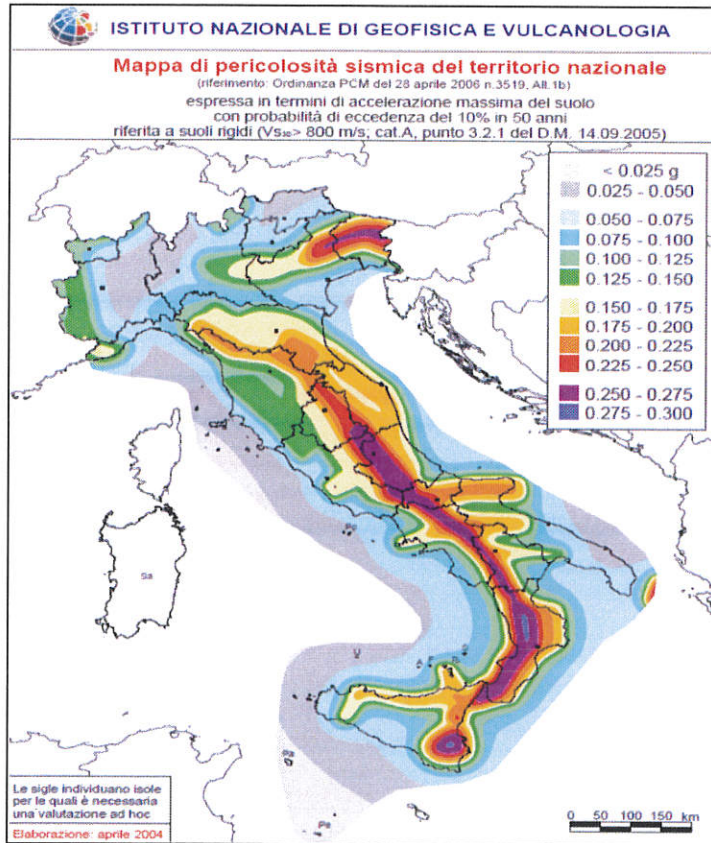
F =	500 DaN 1100 lbs	traction
V =	1000 DaN 2200 lbs	shear

For a correct determination of the anchor type to adopte

- identify the type of the wall/floor to which link the structure(concrete, masonry,...)
- from the producer's handbook select the anchors related to the material to which the structure is linked
- identify the design resistance of the adopted anchor in the producer's handbook table
- confront this reduced resistance with the acting force

SEISMIC CERTIFICATION

The structure is verified for the maximum level of the seismic risk in Italy



The column element is verified for the seismic condition SLV considering the structure with maximum dimension by 2 spans

The adopted verification parameters are the following

The structure is verified for the maximum level of the seismic risk

district Reggio Calabria (maximum level of the seismic risk)

seismic area 1

building type 2

utilization category II

underground category D

topographic category T4

unit: DaN-m if not specified

ag = 2,698 m/s² ground peak acceleration

T*c = 0,36 s

F0 = 2,41

Cc = 2,083

Ss = 1,41

Tb = 0,250 s

Tc = 0,750 s

Td = 2,701 s

q = 1,5 structure factor

building no telaio acciaio o c.a.

C1 = 0,05

h = 3,03 m structure average height
 T1 = 0,115 s fundamental period
 Sd(T1) = 0,692 spectrum ordinate
 I = 1

P = 102,5 DaN 225.5 lbs seismic weight (calculated)
F = P * I * Sd(T1) = 70,9 DaN 156 lbs seismic force acting on the column

seismic actions

column static scheme - cantilever

h = 2,5 m 98.4" column height
 N = P = 102,5 DaN 225.5 lbs axial action at the base
 Tx = F = 70,9 DaN 156 lbs base shear X direction
 Ty = 0,3Tx = 0,0 DaN 0 base shear Y direction
 My = F*h = 177,3 DaNm 118.9 lbft bending moment X direction
 Mx = 0,3My = 0,0 DaNm 0 bending moment Y direction

seismic weight calculation

P = 7 m 275.6" overall depth
 L = 9 m 354" overall width
 h = 2,5 m 98" column height

vertical permanent action

element	g	x	l	x	n	=	Gp
purlin	7,296	x	7	x	0,5	=	25,5
guide	1,952	x	9	x	0,5	=	8,8
gutter	2,487	x	9	x	0,5	=	11,2
bearing profile	2,660	x	9	x	0,5	=	12,0
column	2,660	x	2,5	x	2	=	13,3
column	1,877	x	2,5	x	1	=	4,7
roofing closure	1,000	x	63	x	0,25	=	15,8
perimetral closure	1,000	x	22,5	x	0,5	=	11,3
P =							102,5 DaN 225.5 lbs

action redistribution		X-axis	Y-axis	N	M	T
column	aluminum	0,36	0,59	102,5	104	42
column	timber	0,32	0,21	102,5	37	15

wind and snow load absent in seismic condition

column seismic verification

aluminum

material

type A
 f0 140 N/mm2
 E 70000 N/mm2

profile geometric data

dx 60 mm
 dy 120 mm
 t 2,5 mm
 Jxx 398278 mm4 Jyy 1469344 mm4
 Jxx,eff 398278 mm4 Jyy,eff 1469344 mm4
 wxx,el 13276 mm3 wyy,el 24489 mm3
 wxx,p 13276 mm3 wyy,p 24489 mm3
 wxx,eff 13276 mm3 wyy,eff 24489 mm3
 Area 695 mm2 Aeff 695 mm2
 Atx 600 mm2 Aty 300 mm2
 ix 23,9 mm iy 46,0 mm

verification data

bx 2 by 2
 L0x 5000 mm L0y 5000 mm
 a 0,2
 l0 0,1
 lxx 2,973 lyy 1,548
 Fx 5,207 Fy 5,065
 cx 0,089 cy 0,097
 ax 1 ay 1
 gm 1,10
 Nrd 88455 N
 Mxrd 1689664 Nmm Myrd 3116790 Nmm
 w0 1
 wz 1
 y 1,3
 Vrd,x 44089 N Vrd,y 22044 N

verification

comb	stresses						VERIFICATION			
	N	Vx	Vy	Mx	My	axial-bending		shear		
siv2	102,5	0,0	41,6	104	0	s	cs	csx	csy	
	cs = safety factor		cs < 1		verified	79,9	0,68	0,000	0,019	
						max	0,68	0,000	0,019	

column seismic verification

timber

unit: DaN-m if not specified

material

type	glue laminated timber
category	GL24h
service class	2
load-duration class	short-term
gm =	1,45
k mod =	0,9
k def =	0,8

caratteristiche meccaniche legno			
fm,g,k	24,0 N/mm2	fm,g,d	14,9 N/mm2
ft,0,g,k	16,5 N/mm2	ft,0,g,d	10,2 N/mm2
ft,90,g,k	0,4 N/mm2	ft,90,g,d	0,2 N/mm2
fc,0,g,k	24,0 N/mm2	fc,0,g,d	14,9 N/mm2
fc,90,g,k	2,7 N/mm2	fc,90,g,d	1,7 N/mm2
fv,g,k	2,7 N/mm2	fv,g,d	1,7 N/mm2
E0,g,mean	11600 N/mm2		
E0,g,05	9400 N/mm2		
E90,g,mean	390 N/mm2		
Gg,mean	720 N/mm2		
r,g,k	380 kg/m3		

profile geometric data

section	rettangolare
km =	0,7
lx =	14 cm
ly =	5 cm
A =	70 cm2
j tors =	480 cm4
	x y
w =	58,3 163,3 cm3
j =	145,8 1143,3 cm4
i =	1,4 4,0 cm
span	2,30 m
cantilever	
slope	0 °

stresses

axial action at the base	traction
angle grain/action	0

verification

comb	stresses				
	N (DaN)	Vx (DaN)	Vy (DaN)	Mx (DaNm)	My (DaNm)
0	102,5	0,0	14,6	37	0

static scheme cantilever

verification slu	s (N/mm2)	fd (N/mm2)	safety factor (f=s/fd)	verification	
					compression
traction	0,0 DaN	-----> 0,00	10,24	0,00	
Mx =	37 DaNm	-----> 6,27	14,90	0,42	
My =	0,0 DaNm	-----> 0,00	14,90	0,00	
Ty =	15 DaN	-----> 0,03	1,68	0,02	
Tx =	0,0 DaN	-----> 0,00	1,68	0,00	safety factor -----> f = 0,02 <= 1 verified

instability verification

compression instability 0

bending instability 1

compression instability			bending instability		
	asse X	asse Y		asse X	asse Y
b	2	1	b	2	1
lo	4,6	2,3 m	leff	460	230 cm
l	318,7	56,9	sm,crit	203,1	51,8 N/mm2
lrel,c	5,126	0,915	lrel,m	0,344	0,681
timber	laminated	-----> bc = 0,1			
k	13,879	0,950	k crit,m =	1,00	1,00
kcrit,c =	1,00	1,00			

stresses slu	s (N/mm2)	fd (N/mm2)	safety factor (f=s/fd)	verification	
					compression
traction	0,0 DaN	-----> 0,000	10,2	0,00	
Mx =	36,6 DaNm	-----> 6,27	14,9	0,42	
My =	0,0 DaNm	-----> 0,00	14,9	0,00	

the model resist to the maximum level of the seismic action

ing Alessandro Nutta

